

**NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD**

**RIPARIAN FOREST BUFFER
(ACRE)**

CODE 391

DEFINITION

An area of predominantly trees and/or shrubs located adjacent to and up-gradient from watercourses or water bodies.

PURPOSE

- Create shade to lower water temperatures to improve habitat for aquatic organisms.
- Provide a source of detritus and large woody debris for aquatic and terrestrial organisms
- Create wildlife habitat and establish wildlife corridors.
- Reduce excess amounts of sediment, organic material, nutrients, and pesticides in surface runoff and reduce excess nutrients and other chemicals in shallow ground water flow.
- Provide a harvestable crop of timber, fiber, forage, fruit, or other crops consistent with other intended purposes.
- Provide protection against scour erosion within the floodplain.
- Restore natural riparian plant communities.
- Moderate winter temperatures to reduce freezing of aquatic over-wintering habitats.
- To increase carbon storage.

CONDITIONS WHERE PRACTICE APPLIES

On areas adjacent to permanent or intermittent streams, lakes, ponds, wetlands,

and areas with ground water recharge that are capable of supporting woody vegetation.

CRITERIA

General Criteria Applicable to All Purposes

The location, layout, width, length and woody plant density of the riparian forest buffer will accomplish the intended purpose and function.

Dominant vegetation will consist of existing, naturally regenerated, or planted trees and shrubs suited to the site and the intended purpose.

All buffers will consist of a Zone 1 that begins at the normal water line, or at the top of the bank and extends a minimum distance of 15 feet, measured horizontally on a line perpendicular to the water course or water body.

Occasional removal of some trees and shrub products, such as high value trees, is permitted in Zone 1 provided the intended purpose is not compromised by the loss of vegetation or harvesting disturbance and state or local regulations allow the practice.

Only viable, high-quality and adapted planting stock will be used.

Plantings will consist of two or more species with individual plants suited to the drainage condition of individual planting sites. Plant types and species shall be selected based

Conservation practice standards are reviewed periodically, and updated if needed. To obtain the current version of this standard, contact the Natural Resources Conservation Service. Contact Sally Butler, NRCS IRT Forester at 207-990-9557 or email comments and concerns to sally.butler@me.usda.gov.

on their compatibility in growth rates and shade tolerance. Select species that are common to the area and existing riparian zones or from a variety of plant lists, such as Table 1, located in General Specifications.

An adequate upstream or adjacent seed source must be present when using natural regeneration to establish a buffer.

Necessary site preparation and planting for establishing new buffers shall be done at a time and manner to insure survival and growth of selected species. Refer to General Specifications for site preparation, care, handling, and planting requirements for woody planting stock.

Livestock shall be controlled or excluded as necessary to achieve and maintain the intended purpose.

Harmful pests present on the site will be controlled or eliminated as necessary to achieve and maintain the intended purpose.

For optimal carbon storage, select plant species that are adapted to the site to assure strong health and vigor and plant the full stocking rate for the site.

Comply with applicable federal, state and local laws and regulations during the installation, operation (including harvesting activities) and maintenance of this practice.

Additional Criteria To Reduce Excess Amounts of Sediment, Organic Material, Nutrients, Pesticides in Surface Runoff and Reduce Excess Nutrients and Other Chemicals in Shallow Ground Water Flow.

An additional strip or area of land, Zone 2, will begin at the edge and up-gradient of Zone 1 and extend a minimum distance of 20 feet, measured horizontally on a line perpendicular to the water course or water body. The minimum combined width of Zones 1 and 2 will be 100 feet or 30 percent of the flood plain, whichever is less, but not less than 35 feet.

Criteria for Zone 1 shall apply to Zone 2 except that removal of products such as timber, fiber, nuts, fruit, and forbs is

permitted and encouraged on a periodic and regular basis provided the intended purpose of the riparian buffer is not compromised by loss of vegetation or harvesting disturbance. Zone 2 will be expanded in high nutrient, sediment, and animal waste application areas, where the contributing area is not adequately treated or where an additional level of protection is desired.

A Zone 3 shall be added to the riparian buffer when adjacent to cropland or other sparsely vegetated or highly erosive areas to filter sediment, address concentrated flow erosion, and maintain sheet flow. The Filter Strip standard (practice code 393) shall be used to design Zone 3.

Concentrated flow erosion, excessive sheet and rill erosion or mass soil movement shall be controlled in zone 3 prior to establishment of the lower riparian forest buffer zones.

The width considered to be the riparian buffer for USDA, NRCS program requirements (zones 1, 2 and /or 3) should not exceed 600 feet unless special circumstances warrant.

Additional Criteria to Provide Habitat for Aquatic Organisms and Terrestrial Wildlife.

Width of Zone 1 and/or Zone 2 will be expanded to meet the minimum requirements of the wildlife or aquatic species and associated communities of concern.

Establish plant communities that address the target wildlife needs and existing resources in the watershed.

A buffer width for maximum lowering of warm-season water temperatures shall consist of at least 60 feet or 1 mature tree height for all perennial water course reaches or water bodies. Buffers shall be established or maintained on south and west sides of water courses and bodies insofar as practical. The buffer canopy shall be established to achieve at least 50 percent crown cover with average canopy heights

equal to or greater than the width of the watercourse.

For intermittent watercourses the buffer should shade 85% of the area within 35 feet of the watercourse. (Note: Buffers for the smallest of intermittent streams may consist of shrubs.)

Buffer species shall include those species listed in the Plant List, Table 1, General Specifications, with sufficient height potential. Place drooping or wide-crowned trees and shrubs nearest the water course or body. Shoreline or channel relief (e.g., deeply incised channels) and topographic shading will be taken into account in selecting species.

Within zone 1 as a minimum, establish, favor or manage species capable of producing stems and limbs of sufficient size to provide an eventual source of large woody debris (LWD) for instream habitat for fish and other aquatic organisms. Manage for a continual 60 year old or greater stand of trees for the production of large woody debris (LWD).

CONSIDERATIONS

The severity of bank erosion, concentrated flow erosion or mass soil movement and its influence on existing or potential riparian trees and shrubs should be assessed. Watershed-level or contributing area treatment or bank stability activities may be needed before establishing a riparian forest buffer.

Complex ownership patterns of riparian areas may require group planning for proper buffer design, function and management.

Where concentrated flow or sheet and rill erosion and sedimentation is a concern in the area up-gradient of zone 2, consider the application of a vegetated strip consisting of grasses and forbs. Stiff-stemmed grasses, established at the upgradient edge of zone 2, accelerate deposition of sediment. When concentrated flow or excessive sheet and rill erosion and sedimentation cannot be controlled vegetatively, consider structural or mechanical treatments.

Joining of existing and new buffers will increase the continuity of cover and will further moderate water temperatures. A mix of species with growth forms that are tall and wide-crowned or dropping will increase moderation effects.

For watercourses, buffers established on both sides will enhance multiple values.

Favor tree and shrub species that are native, non-invasive, and/or have multiple values such as those suited for timber, biomass, nuts, fruit, browse, nesting, aesthetics and tolerance to locally used herbicides. Consider species that resprout when establishing new rows nearest to water courses or bodies. For detritus and large woody debris, use species that will meet the specific requirements of fish and other aquatic organisms for food, habitat, migration and spawning.

Use recommendations from regional or other large-scale evaluations and plans when designing, locating and connecting buffers for indicator and/or target species of wildlife, fish and other aquatic organisms. The Buffer Width Guide for Selected Wildlife Species in General Specifications contains guide widths for key species.

Avoid tree and shrub species which may be alternate hosts to undesirable pests or that may be considered noxious or undesirable. Species diversity should be considered to avoid loss of function due to species-specific pests.

Allelopathic impacts of plants should be considered.

The location, layout and density of the buffer should complement natural features and mimic natural riparian forests. Avoid layouts and locations that would concentrate flood flows or return flows. Low, flexible-stemmed shrubs will minimize obstruction of local flood flows. Establish buffers that are wide enough to withstand windthrow in areas prone to excessive and continuous winds.

Drainage tile lines outletting to the water body will compromise the purpose of the riparian buffer. Termination of the tile above

or in the upper most zone so that it follows sheet flow conditions is recommended.

Consider the positive and negative impacts beaver, muskrat, deer, rabbits and other local species may have on the successful management of the riparian and stream system. Temporary and local population control methods of these kinds of local species should be used cautiously and within state and local regulations.

Consider the type of human use (rural, suburban, urban) and the aesthetic, social and safety aspects of the area to determine the vegetation selection, arrangement and management. For example, avoiding shrubs that block views and pruning low tree branches near recreation trails allows for ease of patrolling.

Species selection criteria to improve aesthetics include seasonal foliage color, showy flowers and fruit, foliage texture, form and branching habitat. The layout and design should be appropriate for the setting as determined by adjacent land uses. A landscape analysis can help determine specific aesthetic requirements.

PLANS AND SPECIFICATIONS

Specifications for this practice shall be prepared for each site and recorded using approved specification sheets, job sheets, technical notes, and narrative statements in the conservation plan, or other acceptable documentation.

OPERATION AND MAINTENANCE

The following actions shall be carried out to insure that this practice functions as intended throughout its expected life.

The riparian forest buffer will be inspected periodically and protected from adverse impacts, such as excessive vehicular and pedestrian traffic, pest infestations, pesticides, livestock or wildlife damage and fire.

Replacement of dead trees or shrubs and control of undesirable vegetative competition will be continued until the buffer

is, or will progress to, a fully functional condition.

As applicable, concentrated flow erosion and sediment deposition shall be controlled by an adjacent filter strip or other practice that protects the area.

Any removals of tree and shrub products shall be conducted in a manner that maintains the intended purpose.

For purposes of moderating water temperatures and providing detritus and large woody debris, riparian forest buffer management must maintain a minimum of 50 percent canopy cover. To achieve benefits provided by large woody debris, natural mortality of trees and large shrubs may need to be supplemented by periodically falling and placing selected stems or large limbs within water courses and water bodies to reach original design specifications.

For providing habitat and corridors for wildlife, manage the buffer to favor food, shelter and nesting cover that would satisfy the habitat requirements of the indicator or target wildlife. Refer to Habitat Evaluation Procedures by the U.S. Fish and Wildlife Service or equivalent state document for the particular species.

For purposes of reducing excess pollutants in surface runoff and shallow groundwater (zone 1, 2 and 3), or providing habitat and corridors for wildlife (zone 1 at a minimum), manage the dominant canopy to maintain maximum vigor of overstory and understory species.

Any use of fertilizers, mechanical treatments, prescribed burning, pesticides and other chemicals to assure buffer function shall not compromise the intended purpose.

Additional operation and maintenance requirements shall be developed on a site-specific basis to assure performance of the practice as intended.

NATURAL RESOURCES CONSERVATION SERVICE CONSERVATION PRACTICE SPECIFICATION

RIPARIAN FOREST BUFFER (ACRE)

CODE 391

GENERAL SPECIFICATIONS

Procedures, technical details and other information listed below provide additional guidance for carrying out selected components of the named practice. This material is referenced from the conservation practice standard for the named practice and supplements the requirements and considerations listed therein.

PLANTED RIPARIAN BUFFERS

Planting Densities

Initial plant-to-plant densities for trees and shrubs will depend on their potential height at 20 years of age. Heights may be estimated based on: 1) performance of the individual species (or comparable species) in nearby areas on similar sites, or 2) Table 1-Tree and Shrub Species for Riparian Areas, specifications for tree heights 20 years after planting.

PLANT TO PLANT SPACING

| <u>Plant Types/Heights:</u> | <u>Plants per Acre</u> | <u>in feet:</u> |
|---|------------------------|-----------------|
| Shrubs less than 10 feet in height | 4500 to 1200 | 3 to 6 |
| Shrubs and trees from 10 to 25 feet in height | 1500 to 450 | 5 to 10 |
| Trees greater than 25 feet in height | 1200 to 200 | 6 to 15 |

When establishing a planted buffer, a minimum of two (2) rows of trees and one (1) row of shrubs should be established alongside the water body for maximum shade, stabilization and nutrient uptake within the desired buffer width. The remaining area of the designated riparian zone should be planted or meet natural regeneration requirements. Plantings can be intermixed with open areas treated for natural regeneration and specific wildlife needs. These openings should not exceed 4,356 square feet (1/10 acre) in area. Open

areas should not exceed 25% of the remaining planned riparian zone.

NATURALLY REGENERATING OR DIRECT SEEDED RIPARIAN BUFFERS

Establishment Densities

A naturally regenerated riparian buffer is considered initially established when plant densities have reached the planted buffer recommended densities for trees and shrubs. A three- (3) growing season period is a reasonable amount of time in which to

determine if natural regeneration would take place and be initially established.

Trees and shrubs are considered established when they have begun to dominate herbaceous plants and undesired shrubs that are competing with it for nutrients, water and sunlight.

All areas immediately adjacent to the watercourse should have trees and or shrubs growing near it. Open areas within the area designed as a buffer should not exceed 1/10th acre in size and should not exceed more than 25% of the total designated buffer areas.

CARE, HANDLING, SIZE AND PLANTING REQUIREMENTS FOR WOODY PLANTING STOCK

Planting stock will be cared for and handled as described in Standard and Specification 612, Tree/shrub Establishment.

PREPARATION OF PLANTING AND NATURAL REGENERATION SITES

Planting sites shall be properly prepared based on the soil type and vegetative conditions listed in Forest Site Preparation,

Code 490. For sites to be tilled, leave a 3-foot untreated strip at the edge of the bank or shoreline. Avoid sites that have had recent application of pesticides harmful to woody species to be planted. If pesticides are used, apply only when needed and handle and dispose of properly and within federal, state and local regulations. Follow label directions and heed all precautions listed on the container.

Fabric mulch may be used for weed control and moisture conservation for new plantings on all sites, particularly those with pronounced growing season moisture deficits or invasive, weedy species. Refer to Mulching, 484, for installation procedures.

BUFFER WIDTHS

Even minimum buffer widths provide some benefits to the stream ecosystem. In most instances additional width in excess of basic minimums provides less benefits for specific concerns the further the distance from the stream or water body. It is best to base buffer widths on a large array of concerns, including social and economic needs of the landowner as well as other non-water quality related concerns.

Range of Minimum Width for Meeting Specific Buffer Objective (Palone and Todd)

| <u>Concern</u> | <u>Range of Widths</u> | <u>Concern</u> | <u>Range of Widths</u> |
|------------------|------------------------|--------------------------|------------------------|
| Wildlife | 15 - 600 | Water Temperature | 5 – 75 |
| Flood Control | 100 - 200 | Streambank Stabilization | 15 – 60 |
| Sediment Control | 50 – 200 | Nutrient Removal | 50 – 200 |

BUFFER WIDTH GUIDE FOR SELECTED WILDLIFE SPECIES

Widths below include the sum of buffer widths on one or both sides of water courses or water bodies and may extend beyond riparian boundaries (in such cases refer to Tree/Shrub Establishment, Code 612, for design of upland forests).

| <u>Species:</u> | <u>Desired Width in feet:</u> |
|--|--|
| Bald Eagle, cavity nesting ducks, heron rookery, sandhill crane | 600 |
| Common Loon, Pileated woodpecker | 450 |
| Beaver, dabbling ducks, mink, salmonids | 300 |
| Deer | 200 |
| Lesser Scaup, Harlequin duck | 165 |
| Frog, salamander | 100 |

PLANT LIST

Table 1 lists woody plant species (trees and shrubs) commonly associated with and suited to riparian areas. Key attributes are listed for each plant to assist with the design process for establishing new buffers. In most instances selection of tree and shrub species to be used can be determined by evaluating existing areas that have some of the same characteristics of the site being reestablished.

TABLE 1 - EXPLANATION OF TERMS

Species are grouped by plant type and arranged in alphabetical order by common name. Heights are listed for applicable MLRAs (Major Land Resource Areas, USDA Ag. Handbook 296, Dec. 1981) and precipitation zones. Heights and attributes represent expected performance and characteristics of the individual plant at the reference age in dominant canopy positions on medium-textured, non-saline, neutral pH soils. The reference age for trees is 20 years of age. The reference age for shrubs is 10 years.

Attribute codes H = High, M = Medium, L = Low, Y = Yes, N = No, with special notes about individual species denoted by a letter, e.g. "R".

1. **Shade Tolerance.** The plant's capacity to grow in a shaded condition. H = can

grow in the shade of an overstory; M= can grow in partial shade; L = needs full or nearly full sunlight.

2. **Shade Value.** The density or fullness of shade provided by an individual plant's crown in a full leaf-out condition. H = provides full shade; M = a partially open crown that provides patchy or incomplete shade; L = a very open crown that provides little shade.
3. **Nutrient Uptake.** The plant's general capacity to use excess nutrients such as nitrate-nitrogen. H = can use large amounts; M = some excess nutrients used; L = plant is a low-nutrient user.
4. **Inundation Tolerance.** General capacity of the plant to withstand standing water, low soil aeration conditions. H = can tolerate 10 or more days of inundation; M = can tolerate 2-10 day events; L = can tolerate 1-day or less of inundation.
5. **Soil Saturation Tolerance.** The plant's capability to grow near or in saturated soil conditions. H = plant can withstand "wet feet," M = some tolerance to saturated conditions; L = little or no tolerance of water saturated soil.
6. **Drought Tolerance.** The plant's capability to grow in droughty or dry soil conditions. H = plant can withstand or has physiology to survive droughty periods; M = some tolerance to drought or dry conditions; L = little or no tolerance of dry soil conditions.

7. Aesthetics. A very general rating (H, M or L) that indicates some aspect of the plant, e.g., flowers, special foliage characteristics, or plant part color, that enhances the appeal or viewing of the planting.

8. Native Species. Y indicates the plant is native to the state; N indicates it is introduced.

9. Sediment Deposition Tolerance. H = plant can withstand repeated, deep deposits of sediment; M = plant can withstand repeated, shallow deposits of sediment; L = plant can withstand little or no sediment deposits.

10. Special Notes.

- H trees have the ability to grow out over the to catch sunlight. This increases leaf litter and insects fall into the water.
- L trees have columnar form, with few branches thus being ideal candidates for natural large woody debris when tree naturally falls into the water.
- R trees or shrubs exhibit ability to root from cuttings or natural limb layering
- W trees provide either wildlife cover or forage

TABLE 1 TREE AND SHRUB SPECIES FOR RIPARIAN AREAS

| | HEIGHT AT AGE: 10 20 | TOTAL HEIGHT | 1. Shade Tolerance | 2. Shade Value | 3. Nutrient Uptake | 4. Inundation Tolerance | 5. Soil Saturation Tolerance | 6. Drought Tolerance | 7. Aesthetics | 8. Native Species | 9. Sediment Deposit. Tolerance | 10. Special Notes |
|---|----------------------------|-----------------|--------------------|----------------|--------------------|-------------------------|------------------------------|----------------------|---------------|-------------------|--------------------------------|-------------------|
| Common and Sci Names | | | | | | | | | | | | |
| Tree (Conifer) | | | | | | | | | | | | |
| White Pine (<i>Pinus strobus</i>) | 10 | 24 | 100 | M | M | M | M | M | M | Y | M | L |
| Hemlock (<i>Tsuga canadensis</i>) | 8 | 20 | 70 | M | H | M | L | L | H | H | Y | L/H |
| White Spruce (<i>Picea glauca</i>) | 8 | 22 | 80 | M | L | M | M | M | H | M | Y | L |
| Black Spruce (<i>Picea mariana</i>) | 8 | 22 | 70 | M | L | M | H | H | M | M | Y | M |
| Tamarack (<i>Larix laricina</i>) | 10 | 32 | 60 | L | L | M | M | M | L | H | Y | L |
| Northern White-Cedar (<i>Thuja occ</i>) | 6 | 18 | 60 | M | M | M | M | M | M | H | Y | H/R |
| Tree (Deciduous) | | | | | | | | | | | | |
| Red Maple (<i>Acer rubrum</i>) | 10 | 25 | 60 | H | H | M | M | M | M | H | Y | M |
| Black Willow (<i>Salix nigra</i>) | 12 | 30 | 60 | H | M | L | H | H | L | L | Y | H |
| Bass Wood (<i>Tilia americana</i>) | 18 | 26 | 70 | H | M | H | M | M | L | M | Y | M |
| Grey Birch (<i>Betula populifolia</i>) | 15 | 25 | 30 | L | L | L | L | M | M | L | Y | L |
| White Birch (<i>Betula papyrifera</i>) | 15 | 34 | 70 | L | L | L | L | L | M | H | Y | L |
| White Ash (<i>Fraxinus americana</i>) | 18 | 36 | 70 | L | L | M | L | L | M | M | Y | L |
| Black Ash (<i>Fraxinus nigra</i>) | 16 | 30 | 60 | L | L | M | H | M | L | L | Y | M |
| Shrub | | | | | | | | | | | | |
| Speckled Alder (<i>Alnus rugosa</i>) | 6 | 12 | 20 | M | M | M | M | H | M | L | Y | H |
| Red Osier Dogwood | 6 | 15 | 15 | L | L | M | M | H | M | H | Y | H |
| Alternate-leaf Dogwood (<i>Cornus alternifolia</i>) | 6 | 15 | 20 | M | L | M | M | H | M | M | Y | H |
| Pussy Willow (<i>Salix bicolor</i>) | 6 | 12 | 12 | M | L | M | H | H | M | M | Y | H |
| Nannyberry (<i>Viburnum lentago</i>) | 5 | 9 | 30 | M | M | M | M | M | M | M | Y | H |
| Witch Hazel (<i>Hamamelis virginiana</i>) | 6 | 18 | 20 | M | L | M | M | M | M | H | Y | M |
| Streamco willow | 6 | 8 | 12 | M | L | M | M | M | M | M | N | H |
| Bankers Willow | 6 | 8 | 12 | M | L | M | M | M | M | M | N | H |

REFERENCES

1. U.S. Department of Agriculture, Forest Service, Northeastern Area State and Private Forestry, 1991. Riparian Forest Buffers-Function and Design for Protection and Enhancement of Water Resources. NA-PR-07-91. Prepared by: David J. Welsch, Radnor, PA.
2. U.S. Department of Agriculture, Forest Service, Southern Region, 1992. Stream Habitat Improvement Handbook. Tech. Publ. R8-TP 16. Prepared by: Monte E. Seehorn, Atlanta, GA.
3. U.S. Environmental Protection Agency for the Chesapeake Bay Program, 1995. Water Quality Functions of Riparian Forest Buffer Systems in the Chesapeake Bay Watershed. Technology Transfer Report. EPA 903-R-95-004 CBP/TRS 134/95. Prepared by the Nutrient subcommittee of the Chesapeake Bay Program.